PC/FORTH™

If you want total control over your IBM® Personal Computer . . . If you are interested in graphics, games, communications, robotics, data acquisition, or process control . . . you should be using FORTH!

- FORTH is interactive and conversational like BASIC, but twenty times faster.
- FORTH programs are highly structured and modular, easy to maintain.
- FORTH gives you direct control over all interrupts, I/O ports, and memory locations.
- Your application programs can be compiled into turnkey COM files and distributed with no license fee.
- Quarterly user newsletters, inexpensive updates, free telephone technical support.
- Fastest FORTH available for the IBM PC. Compatible with PC/XT, Compaq, Eagle PC, Columbia PC, and all hard disks.

The PC/FORTH package includes the FORTH interpreter/compiler with virtual memory management and background multitasking, a full screen editor optimized for the PC, an 8088 assembler with Intel standard mnemonics and local labels, a reverse translator, debugging aids, utilities, and many demonstration programs. The 180 page manual contains a general user's guide, detailed operating instructions for the editors and assembler, a technical overview of the internal workings of FORTH, a tutorial with bibliography, and a complete glossary listing.

PC/FORTH pioneered the use of standard operating system files for screen storage, making it truly hardware independent. FORTH programs and data coexist on the disk with other applications and may be manipulated by standard system utilities. The FORTH vocabulary has been extended to give full access to all operating system facilities including file and record management, parallel and serial port i/o, and real-time clock. The basic package also includes full control over video display modes, foreground, background, and border colors, point plotting and line drawing, and tone generation.

Software developers: our FORTH Cross-Compiler allows you to create dedicated disk or ROM-based application programs written in FORTH for a variety of microprocessors, using the IBM PC as your development system. No license fee or royalty for programs generated with the Cross-Compiler!

PC/FORTH™ **$100.00**
Specify PC-DOS, CP/M-86, or Concurrent CP/M86. Upgrade to PC/FORTH + available.

PC/FORTH +™ **$250.00**
Allows creation of FORTH programs up to 1 megabyte in size.

FORTH Cross Compiler **$300.00**
Choose target microprocessor from Z-80, 8080, 8086/88, IBM PC, LSI-11, 68000, 6502, Z-8, 1802.

Programmer's Package #1 . . . . . **$250.00**
PC/FORTH, Advanced Graphics, Symbolic Debugger, Cross Reference Utility, and "Starting FORTH".

DEMO Disk **$5.00**
Requires graphics card.

Extension Packages

Advanced Color Graphics	$100.00
Intel 8087 Support	100.00
Software Floating Point	100.00
Interactive Symbolic Debugger	100.00
PC/GEN™ Custom Character Sets	50.00
PC/TERM for Smartmodem	60.00
QTF + Editor/Screen Formatter	100.00
Curry FORTH Programming Aids	150.00
Hierarchical File Manager	50.00
B + Tree Index Manager	125.00
B + Tree File and Index Manager	200.00
Quad Precision Integer Math Pack	25.00

Intel 8087 Processor **$250.00**

"Starting FORTH" tutorial **$16.00**

PC/FORTH requires 48 kbytes RAM and 1 disk drive, Cross Compilers require 64 kbytes RAM. PC/FORTH + requires 128 kbytes RAM. Prices include shipping by UPS or first class mail within USA and Canada. California residents add appropriate sales tax. Master Charge and Visa accepted. We also sell FORTH's for 8080, Z-80, 8086/88 (including TI Professional, Zenith Z-100, and DEC Rainbow), and 68000 based microcomputers.

Laboratory Microsystems Incorporated
4147 Beethoven Street, Los Angeles, CA 90066
Phone credit card orders to ***(213) 306-7412***

Extensions for PC/FORTH™

Software Floating Point

A binary floating point which is a 32 bit (single precision) emulation of the AMD 9511 arithmetic processor, providing 7 significant digits in the mantissa and a dynamic range of 1 E -18 to 1 E 19. Fast enough for graphics and process control applications, but not recommended for business programs because of the limited precision. Functions include floating point add, subtract, multiply, divide, square root, raise number to power, log, antilog, sine, cosine, tangent, max, min, abs, change sign, apply sign, formatted real number display, and the usual stack and comparison operators.

Intel 8087 Support

Expands the PC/FORTH command set with extremely fast 64 bit integer and floating point capabilities. Machine language drivers compiled into the system nucleus control the arithmetic processor and manage all data transfers, no special coding or knowledge of the 8087 numeric processor is needed in your applications. Functions include all of those listed for the software floating point package plus inverse trig, hyperbolics and inverse hyperbolics, user selectable rounding modes, and more. Programs written to use our software floating point package will run on the 8087 supported FORTH without modification, but with a dynamic range of 1 E -307 to 1 E 308, 17 digits of precision and many times the speed. Some sample benchmarks:

operation (5000 iterations)	Microsoft Fortran (32 bit precision)	PC/FORTH with 8087 (64 bit precision)
multiply	5.1 sec.	1.8 sec.
divide	20.9 sec.	1.8 sec.
sine	6 min. 59 sec.	6.4 sec.
square root	5 min. 45 sec.	1.2 sec.

Color Graphics Extension

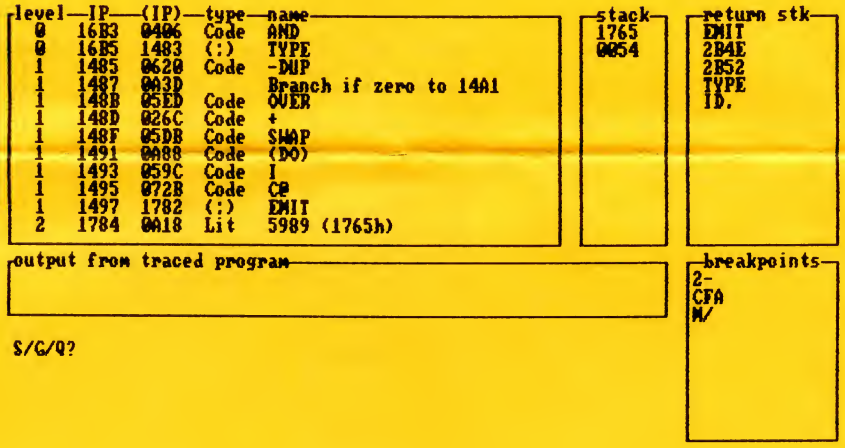
Adds many sophisticated graphics capabilities to those present in the basic PC/FORTH system. Includes full control of foreground, background, and border colors in text or graphics modes. Plot commands for POINT, LINE, BOX, CUBE, TRIANGLE, ARC, CIRCLE, ELLIPSE, and PAINT. Animation is supported with commands equivalent to PC-BASIC's "GET", "PUT", and "PUT XOR". Other facilities include pixel editing,window support, light pen support, optical mouse support, turtle graphics, saving or loading graphics images between memory and disk, and several different graphic dump utilities for the Epson printer.

PC/TERM Modem Support

PC/TERM is a Modem/Communications utility written in PC/FORTH for the DC Hayes Smartmodem. Its capabilities include autodialing, dial until answer, user configurable phone number menu and communications parameters, file transfer with XMODEM protocol, long distance carrier support, optional simultaneous printing, and disk directory display. PC/TERM includes all source code and a 26 page manual.

All extension packages available from
Laboratory Microsystems Inc.

PC/FORTH™ Interactive Debugger



- Dynamic display of trace audit and stacks
- Symbolic breakpoints
- Trace execution of FORTH programs to any desired level of nesting

Currently available for PC/FORTH running under PC-DOS or CP/M-86® . Versions available soon for our other FORTH systems.

Price: $100.00 (includes all source code)

Laboratory Microsystems, Inc.

4147 Beethoven St.
Los Angeles, CA 90066

PC/GEN™ $50!

PC/GEN is a friendly, menu-driven interactive program that allows you to design new character sets for IBM® Personal Computers equipped with the color/graphics video interface. User defined fonts are stored in disk files and may be loaded as required by other application software.

main menu

```
00:46  10/17/82  Character matrix entry program

Current character file = b:ibm.chr

Matrix size:  X = 8   Y = 8

D = Display complete graphic character set
E = Enter new character
M = Modify previous character
R = Read character table from disk
S = Display special character set only
T = Display complete text mode character set
W = Write character table to disk
X = Exit

Select function:
```

sample character entry screen

```
character number 65
```

```
Any char=set cell   Space=clear cell
Arrow keys move cursor,  ESC = quit
```

Package includes PC/GEN, character font linker for your application software, three custom character sets designed by Laboratory Microsystems, and PC/GEN source code in PC/FORTH™. Software supplied on 5¼ inch soft sectored single-sided double-density diskettes. Price includes shipping by UPS or first class mail within USA and Canada. California residents add appropriate sales tax. Specify PC-DOS or CP/M-86® .

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FORTH +™

for the 68000, 8086/88, and IBM PC

Have your programs outgrown the 64 kbyte dictionary size restriction of ordinary 16 bit FORTH systems? Laboratory Microsystem's FORTH + makes the entire 1 mbyte memory space of the 68000 or 8086/88 processor available as directly addressable "dictionary" workspace! In a 128 kbyte machine, you can have the operating system, FORTH +, the full screen editor, and assembler all co-resident, and still have over 72 kbytes of dictionary space left for your application software.

What is FORTH +?

FORTH + is an upward compatible implementation based on a 32 bit virtual machine. This means that all addresses as seen by the FORTH programmer are 32 bits long, and the data and return stacks are 32 bits wide. To conserve dictionary space on the 8086, we have developed a novel compilation technique that allows mixed 16 and 24 bit addresses in the threaded code. FORTH + configures its buffers and stacks to take maximum advantage of the amount of memory installed in your machine — if you need more dictionary space, just plug in more RAM!.

What about Speed?

FORTH + generally runs slower than the basic 16 bit FORTH package, since all primitive operations are being done on 32 bit instead of 16 bit data. On 8086/88 based machines, there is additional overhead in the "inner interpreter" to sense the proper segment for the threaded code, and to "nest" and "un-nest" 32 bit addresses on the return stack. The exact amount of degradation in execution speed varies widely with the type of application and your programming style, but will be in the range of 10 - 20% on the 68000 and 25 - 50% on the 8086/88.

How Compatible is FORTH +?

For our own benefit as well as yours, FORTH + has been designed to be as compatible as possible with the basic PC/FORTH, 8086 FORTH, OR 68000 FORTH programming package. Most "high level" FORTH applications should compile and run without any modification, as long as they are not sensitive to the physical structure of the dictionary. Any CODE definitions will have to be examined carefully to avoid conflict with the FORTH + virtual machine registers. A detailed guide to compatibility and potential trouble spots is provided in the FORTH +. manual.

Price and Availability

The retail prices are: 8086 FORTH + $250.00, PC/FORTH + $250.00, and 68000 FORTH + $400.00. All three systems are ready for delivery now. Previous owners of PC/FORTH, 8086 FORTH, and 68000 FORTH will receive a discount equal to the purchase price of their original system; include serial number from original distribution disk with order. California residents add appropriate sales tax. Shipping by UPS surface or first class mail in USA or Canada included. Visa and MasterCard accepted.

Laboratory Microsystems, Inc.
4147 Beethoven Street
Los Angeles, CA 90066
(213) 306-7412

I wrote it. I use it.

So I'm impatient . . .
I can't stand waiting for a word processor to slog through my document while I'm trying to locate a paragraph. I want a writing tool that responds as quickly as I can think.

So I'm lazy . . .
I don't want to arrange things on every page, or type control keys to make each section-title boldfaced. I want to describe my document in *logical* terms, and let the system do the formatting.

Leo Brodie

You see, ordinary word processors rise a step above the tedium of the typewriter by letting the writer "type" on a CRT. **QTF+** rises *two* steps above. The writer can define personalized formatting commands, in FORTH, using **QTF**'s text formatting language. Even define commands that set commonly-used text, perform calculations, or access data bases.

So maybe I'm arrogant . . .
I know the world is already packed with word processors. But I wrote **QTF+** because I needed it; I believe its approach is far more powerful. Maybe you'll agree. I've written a complete, 80 page User's Guide, including tutorial and reference sections, to make using **QTF+** as much a joy for you as it is for me.

Editing Features: cursor controlled editor — exact status of text visible at all times; insert; delete; replace; move strings. "Review" feature allows you to display the document on the terminal as it will appear in print.

Formatting Features: justification, centering, tabbing, hanging indent, headers and footers, automatic page numbering, soft hyphenation, FORTH "screen" formatting, illustration formatting.

Epson Printer Features: bold face, underlining, compressed mode, double-width mode, "big" mode, low-resolution high speed printing for draft copies or high-resolution (emphasized) printing for finished documents.

QTF+
The documentation tool for FORTH programmers.

Laboratory Microsystems, Inc.
4147 Beethoven Street
Los Angeles, CA 90066

68000 8086 FORTH Z-80® 8080

If your applications include communications, graphics, process control or data acquisition . . .

If you are using assembly language for any part of your task . . .

You should be using FORTH!

- FORTH Is interactive and conversational like BASIC.
- Your FORTH programs are instantly portable across the four most popular microprocessors.
- FORTH's performance can approach the speed of equivalent assembly language programs.
- FORTH gives you direct acess to all memory addresses and I/O ports.
- FORTH's compiler includes constructs that support modular, structured programming.
- FORTH includes a user controlled virtual memory facility for program text and data.
- FORTH's compiler is user-extensible, and permits easy user definition of new data types and control structures.

Our FORTH program development packages include the interpreter/compiler with background multitasking and virtual memory management, full screen (visual) editor with user customizable control codes, line editor, assembler with local labels and forward referencing capability, reverse translator, debugging aids, and utilities. The 130 page manual includes a general user's guide, detailed operating instructions for the editors and assembler, a technical overview of the internal workings of FORTH, a tutorial with bibliography, and a complete glossary listing.

Laboratory Microsystems pioneered the use of standard CP/M® random access disk files for FORTH screen storage. FORTH programs and data coexist on the disk with other CP/M applications and may be manipulated by the CP/M utilities. All disk and console I/O is done via standard CP/M function calls, thus the system is truly hardware portable. Laboratory Microsystems FORTH implementations have been used successfully on every type of mass storage disk device ranging from Micropolis quad density to Winchester hard disks.

Extension packages currently available include software floating point (32 bit precision), AMD 9511 or Intel 8087 hardware assisted floating point, and FORTH Cross-Compilers for a variety of target processors. MSDOS version of 8086 FORTH currently available—compatible with TI Professional, Zenith Z-100, Victor 9000, and all IBM PC "look-alike" personal computers. 83-standard version available soon. All registered users will be entitled to an update at nominal cost.

Z-80 and 8080 FORTH require 48 Kbytes RAM. 8086 and 68000 FORTH require 64 Kbytes RAM. Disk formats available include: 8" standard CP/M SSSD, Northstar 5¼" QD, Kaypro 5¼", Apple 5¼", Micro-Mate 5¼", Micropolis 5¼" QD, Osborne 5¼" DD, and Victor 9000. Most other formats can be special ordered.

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FORTH Cross-Compiler

The Cross-Compiler is an extremely powerful tool which may be used to generate a new FORTH interpreter/compiler for virtually any computer. The Cross-Compiler is a complex program and is intended for use by experienced FORTH programmers; it requires a detailed understanding of the architecture and instruction set of both the host and target processors.

The Cross-Compiler allows you to rapidly extend or modify the entire FORTH runtime system without ever leaving the FORTH programming environment. For example, you can optimize the nucleus primitives for increased speed, change the action of compiler words, add new control structures, or create new device drivers. In addition, the power of the Cross-Compiler allows you to recompile on a host computer for a different target computer, generate headerless code, and generate ROMable code with initialized variables.

Forward referencing to any word or label is supported, thus your application source code may be organized for your own convenience and frequently invoked words may be relocated high in the dictionary to minimize search time. The Cross-Compiler produces a load map, list of unresolved symbols, and an executable target image in RAM or disk file.

The Cross-Compiler is FAST. An entire FORTH system can be compiled in about three minutes on a Z-80 host running at 4 mHz. In contrast, assembling the same FORTH system using MAC takes ten minutes or more.

Documentation includes a 150 page manual with detailed explanations of: defining words, vocabularies, Cross-Compiler directives, forward referencing, producing ROMable code, writing an Assembler, and the full source code of the Cross-Compiler.

Hosts available:	Z-80	(CP/M2.2 or MP/M II)
	8086/88	(CP/M-86 or MS-DOS)
	68000	(CP/M - 68k)
	IBM-PC	(PC-DOS or CP/M-86)

Targets available: 8080, Z-80, 8086/88, 6502, LSI-11, Z-8, 1802, 68000.
The target code includes a fig-FORTH public domain nucleus.

There is no royalty or license fee for programs created with the FORTH Cross-Compiler. Of course, the compiler itself is sold for use on a single computer system and may not be further distributed.

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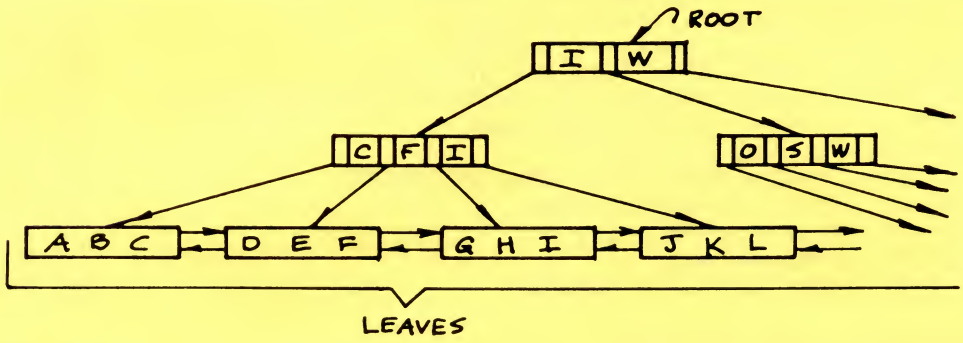
FORTH INDEX + ™

B-Tree ISAM Package

INDEX + , the latest in B-Tree ISAM technology, is now available as a tool in FORTH. Using INDEX + , the FORTH programmer can quickly create and maintain any number of keyed indexes to data files. Features of INDEX + include:

- Implements full B + Tree structure
- Add and Delete keys in any order
- Search randomly by key value
- Search sequentially forward and reverse
- Variable length keys up to 256 character long
- Duplicate keys supported
- Supports BLOCK disk I/O or standard DOS or CP/M files
- fig-FORTH compatible



The INDEX + package includes fully documented source code with a complete manual. The manual includes tutorials covering B + Tree technology and techniques for using the package. Also provided is a full glossary and source listing of the INDEX + words.

INDEX + is easy to use. The programmer need only learn nine new FORTH words to accomplish all indexing functions.

INDEX + supports standard BLOCK disk I/O and will also utilize the Laboratory Microsystems operating system file interface (CP/M® and MS-DOS). The FORTH programmer is free to use any desired data file format.

INDEX + is written for Laboratory Microsystems FORTH, including Z80-FORTH, PC/FORTH™, 68000 FORTH, and 8086 FORTH. INDEX + is supplied in either 8″ standard single density format, or 5¼″ IBM PC-DOS or CP/M format. Price: $125.00 postage paid.

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Laboratory Microsystems Inc.

Retail Price List, November 1983

FORTH Application Development Systems	
Z-80 FORTH for CP/M 2.2 or MP/M II	$ 50.00
8080 FORTH for CP/M 2.2 or MP/M II	50.00
8086 FORTH for MS-DOS or CP/M-86	100.00
PC/FORTH for PC-DOS, CP/M-86, or CCPM	100.00
68000 FORTH for CP/M-68K	250.00
FORTH+ Systems (32 bit implementations)	
PC/FORTH+ for PC-DOS	$250.00
8086 FORTH+ for CP/M-86	250.00
68000 FORTH+ for CP/M-68K	400.00
Extension Packages	
Software floating point (Z-80, 8086, PC only)	$100.00
AMD 9511 support (Z-80, 8086, 68000 only)	100.00
Intel 8087 support (8086, PC only)	100.00
Advanced color graphics (PC only)	100.00
Symbolic interactive debugger (PC only)	100.00
PC/TERM Communications/file transfer for Smartmodem	60.00
Quad precision integer math pack	25.00
Cross reference utility	25.00
PC/GEN (custom character sets, PC only)	50.00
Curry FORTH Programming Aids	150.00
Hierarchical file manager	50.00
B-Tree index manager	125.00
B-Tree index and file manager	200.00
FORTH Native Code Compiler	
for Z-80 FORTH and CP/M 2.2	$100.00
for 8086 FORTH or PC/FORTH, MS-DOS or CP/M-86	200.00
FORTH Target Compilers	
Hosts: 8080, 8086/88, IBM PC, 68000, Z-80	
Targets: 8080, Z-80, 8086/88, IBM PC, LSI-11, 6502, Z-8, 1802, 68000	
Compiler for one host and one target	$300.00
Each additional target, same host	100.00
QTF+ Screen editor and text formatter by Leo Brodie for IBM PC only	$100.00
AUGUSTA, Ada subset compiler from Computer Linguistics for Z-80 CP/M 2.2 systems	$ 90.00
Z-80 Machine Tests with source code	$ 50.00
"Starting FORTH" tutorial by Brodie, softcover	$ 16.00
Intel 8087-3 Numeric Coprocessor	$250.00

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